# Report for the Center of Independent Experts on the Review Panel for Eastern Bering Sea Pollock Stock Assessment and Management Methods (June 28 to July 1, 2010)

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**Eastern Bering Sea Pollock Stock Assessment and Management Methods**

Alaska Fisheries Science Center
Seattle, Washington
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## Executive Summary

A Center of Independent Experts (CIE) review panel was convened to review the stock assessment model and background information for the Eastern Bering Sea (EBS) pollock stock assessment and management. The previous review of EBS pollock was conducted in 2000. EBS Pollock is categorized as a tier 1 stock indicating that there is enough information to provide reliable estimates of the of $B_{MSY}$ and $F_{MSY}$ reference points as well as an estimate of the probability density function for $F_{MSY}$ allowing for uncertainty adjustments to estimate $F_{ABC}$. The current prognosis is that the female spawning stock biomass is estimated to be below the $B_{MSY}$ level for 2010 but is increasing and presently projected to be above $B_{MSY}$ by 2012. The mainstay of this projection is the 2006 year-class, the size of which has already been revised downwards. In fact, the spawning stock biomass is approaching the $B_{20\%}$ limit for no-directed fishing and the method proposed to calculate the probability of passing this limit needs study and evaluation. The model tends to overestimate next year's biomass which has caused some concern about the current prognosis. Fishing selectivities are allowed to vary over time in the model which results in annual changes in the reference points and limits. Ageing error appeared to higher than expected for gadoids in other areas of the world and this error should be included in the model.

As a tier 1 stock the stock assessment model has high demands in terms of data and consequently, high expectations in terms of performance and applicability given the economic value of this fishery. Despite the concerns raised, the stock assessment model represents the best scientific information available for provision of advice on this stock. The fishery and non-fishery data support programs are of high quality and the level of cooperation between the industry and NMFS is enviable. Provisions for avoiding bycatch and maintaining a level of biomass for ecosystem needs ($B_{20\%}$) are strong contributors to an ecosystem-based system of management.

## Background

A Center of Independent Experts (CIE) review panel was convened at the Alaska Fisheries Science Center (AFSC) of the US National Marine Fisheries Service (NMFS) in Seattle, Washington, from June 28–July 1, 2010 to review the stock assessment model and background information for the Eastern Bering Sea pollock stock assessment and management. Fisheries off of Alaska account for 50% of the total catch of fish and invertebrates in the United States and Eastern Bering Sea (EBS) pollock is the largest stock of fish in Alaska in terms of biomass and landings. Within the US fisheries management situation, EBS pollock is classified as a tier 1 stock — that is, there are reliable estimates of the reference points of $B_{MSY}$ and $F_{MSY}$ as well as an estimate of the probability density function for $F_{MSY}$ reflecting the uncertainty associated with the estimate of this reference point. In addition, this fishery has an extensive observer program that supplies data on catch, size and age composition of the catch as well as data on bycatch including prohibited species (e.g., salmon). The previous review of EBS pollock was conducted in 2000 by Kevin Stokes who also sat on the current panel.

**Reviewer's Role in Review Activities**

The review was focused on the input data, biological knowledge, stock assessment methodology, harvest strategy and future research for EBS pollock. The current advice was not under review per se as the most recent stock assessment available was presented and accepted in 2009, and the 2010 fishery was probably half over by the time of the review. However, attention was paid to how the stock assessment advice for the 2010 fishing year was arrived at. A large number of documents, including the chapter from the 2009 SAFE report detailing the stock assessment, were provided via a website to the panel prior to the meeting (Appendix 1).

The meeting was structured with formal presentations on an overview of EBS pollock biology, fishery, and history of assessment, fishery-independent data, fishery data, management, and assessment model details. There were three CIE panel members in attendance as well as AFSC staff, North Pacific Council staff, industry representatives and non-governmental organization representatives (see Appendix 3). Jim Ianelli, the lead assessment scientist for EBS pollock and Anne Hollowed, NMFS Senior Scientist, co-chaired the meeting with respect to managing the agenda (Appendix 3). The members of the CIE panel functioned as the audience for the presentations and directed questions to the presenters and others in an informal setting.

**Summary of Findings**

The terms of reference given below were quite broad and the material presented covered a wide range of topics. The panel faced the difficulty of where to concentrate their time and attention given the short amount of time available. In fact, one could easily spend a whole week on any one of the terms of reference given the level of detail and work that goes into the activities covered by these terms of reference. In the end, the panel decided to focus more directly on the stock assessment itself and invest time into material about the input data, biology, etc., when questions arose about interpretation and impact on the final estimates. Even though less attention was paid to other aspects, such as abundance trends in the Bogoslof area, design and estimation details of the bottom trawl and acoustic trawl, the economic modeling projects, and the Bering Sea Ecosystem Research program, this should not be perceived as indicating that these topics had lower importance or interest — there was just not enough time.

Terms of Reference

a) Evaluation, findings, and recommendations on quality of input data and methods used to process them for inclusion in the assessment (specifically fishery and survey data).

   The observer coverage in this fishery is impressive with "200%" coverage (2 observers sampling 24 hours a day) for the mother/factory ships, 100% for catcher/processor vessels 125 ft and greater and 30% for vessels between 60 and 124 feet. The latter class of vessels will move to 100% coverage in 2011 to improve monitoring of salmon bycatch. The additional bonus of the industry being able to use the observer program to manage its operations is particularly noteworthy. No variance estimates are available at present but there is a research program in place to develop these. Total/area wide estimates for the 30% coverage fleet are based on imputing estimates for unobserved vessels using a nearest-neighbors approach based on observed vessels. There is a study beginning to evaluate this approach by subsampling the 100% observed catcher/processor vessels and testing the imputation process with known complete data.

Annual survey estimates are the backbone of many stock assessments throughout the world but too often designs and methods get set into stone and the surveys suffer from the lack of investment and innovation. The presenters for both the bottom trawl and acoustic surveys briefly summarized recent research efforts, such as the effect on light levels on catchability, application of an empirical multi-frequency method for backscatter classification, interaction between vessel noise and fish behavior and size-selectivity studies. The center's investment into understanding and improving their tools is to be commended.

Two projects anticipating immediate and long-term future needs were also presented. The acoustic survey will be directed to the Gulf of Alaska (GOA) next year and return to its biannual cycle of surveying either the GOA or the EBS. Since 2002, there has been a feasibility study funded through a Pollock Conservation Cooperative Research Center grant to estimate spatial and temporal distribution patterns of pollock using un-calibrated acoustic data from the commercial fishing vessels used to conduct the annual bottom trawl survey. The preliminary results from this study compare quite closely with those of the NMFS acoustic survey and continued use of this approach should provide an adequate substitute in years the acoustic survey is not being done in the EBS. With respect to the long-term, there are plans to extend both the bottom trawl and acoustic surveys northward to collect data in anticipation of possible changes in distribution due to climate change.

b) Evaluation, findings, and recommendations on the level and adequacy of knowledge on pollock stock structure, biology, and life history.

The genetic work presented suggested that there was little differentiation amongst areas within the Bering Sea and some evidence for isolation by distance over broad scales of the North Pacific, perhaps as a result of separate areas of glacial refugia in the east and west with subsequent postglacial expansion. The chart presented from the Pollock Movement Workshop (Seattle, WA, July 7–10, 2009) showing the broad ontogenic movement of the pollock in the Eastern Bering Sea and Aleutian Islands seemed to support the conclusion that there would be little genetic differentiation and therefore assuming that the area covered by the fishery and surveys in the Eastern Bering Sea represented a genetically homogenous stock seemed reasonable. There was some discussion about the future possibility of how Expressed Sequence Tagged Linked microsatellites might reflect environmental effects and could possibly provide indicators of future viability of a cohort. The possibility that fishing may result in a loss of diversity was briefly discussed but was not thought to be detectable based on experience with cod. In addition environmental changes are expected to result in changes to diversity that may swamp what fishing could be doing.

The current (and past assessments) assume the natural mortality on ages 3 plus is constant and equal to 0.3 while mortalities at age 1 and 2 are set at 0.9 and 0.45, respectively. The higher mortalities on the first two ages reflect effects due to cannibalism and the importance of pollock as a forage fish. Results from a natural mortality workshop held by NMFS in August 2009 were briefly discussed. Although mortality estimates for pollock from this workshop tended to come out higher but with a similar pattern with age, the current estimates were retained as being precautionary.

Little was presented on maturity to the panel. There was reference to data collected in 2002 and 2003 and a subsequent analysis that confirmed the maturity-at-age estimates used in the current assessment. The analysis was reported in a paper by Stahl and Kruse in 2008 which was made available to us later in the day.

Two issues did arise during the presentation on age and growth. The first concerned the current practice of allowing age-readers to use either surface reading or one of two kinds of break and burn preparation (a toaster oven or an ethanol flame) at their own discretion. AFSC staff believed that age readings by the different methods were consistent and they stated that the break and burn methods tended to be used for older fish. A summary of the proportion of samples using break and burn by three different sources of otoliths, confirmed this relation with older fish in the samples for trawl and acoustic survey data but the usage of either surface or break and burn methods for fishery samples seemed to be independent of average age. This issue came to our attention because in our subsequent discussions about incorporating ageing error into the stock assessment, it was not clear what if any impact the different preparation methods would have on such estimates of error.

The second issue arose from noting that although the between reader agreement on ages was about 58% overall there was a strong decline in percent agreement with increasing age. At age 4, agreement was around 80% but had declined to close to 45% by age 10. Examples of otoliths presented to us appeared to be easy to read but we were told that most pollock otoliths were very difficult to read and that AFSC staff were satisfied with 58% agreement. Chris Darby suggested that this level of agreement was worrisome and low compared to agreements of 90%+ for Atlantic cod. Granting the difficulty of reading pollock ages, this level of agreement argued for including ageing error into the assessment. Jim Ianelli stated that ageing errors had been investigated for the stock assessments from 2003 to 2006 but were not included at present because they caused issues with recruitment estimates.

c) Evaluation, findings, and recommendations of the analytical approach (application of a statistical ADMB integrated catch-age model) used to assess stock status and estimation/presentation of uncertainty including MSE approaches.

The stock assessment model for this stock is probably the most complex that I have had experience with as it uses 772 parameters to integrate a large number of data sources. The review of the model used in the 2009 assessment by Dr. Steven Martell was particularly helpful in understanding many of the key elements of the model. The review was also noteworthy in demonstrating the transparency of the modeling process for this stock as Dr. Martell had access to all of the documentation and ADMB code for his review. While all of the panel members had access to Martell's document and the 2009 assessment prior to the meeting, understanding a model of this complexity is more efficient with its author, Jim Ianelli, in the same room.

In the time available the panel concentrated on a number of questions that arose from trying to reconcile the decline in biomass in recent years evident in Figure 1.35 (SAFE document) with recent relative fishing mortalities being below the $F_{ABC}$. This trend was of concern especially as the relative spawning stock biomass is approaching the $B_{20\%}$ "stop directed fishing" level and the model has been shown to overestimate when predicting the next year's spawning stock biomass (Fig. 1.34). A decline in biomass is not wholly unexpected given that there has not

been a strong recruiting year-class in recent years. In addition, trends in spawning exploitation rate (Fig. 1.33) indicated a sharp decline in exploitation rate from 2006 to 2008 contrary to the flatter trend for the relative fishing mortalities in Fig. 1.35.

The document included the application of a new technique for management strategy evaluation (MSE) of the probability of the point estimate of spawning stock biomass falling below $B_{20\%}$ in 2011 by generating new data for 2010 conditioned on the full posterior distribution from the model and simulated future survey and fishery data for 2010. We recommended that this approach should be thoroughly evaluated given the model's tendency to overestimate next year's spawning stock biomass (see below).

The original document lacked basic diagnostic information needed (e.g., residuals, F-at-age, likelihood components for different fits) to help disentangle the influence of the different data sources on the model behavior.

In the end, it appears that allowing for changing selectivity-at-age in model underlay most of the reasons for the apparent different trends in exploitation, relative biomass and fishing mortality. Given that spawning stock biomass, MSY reference points, etc., are all functions of selectivity, the panel proposed that the following issues be explored. Jim Ianelli presented his responses to these requests on the morning of the last day of the meeting with written text and figures supplied the following day.

*i.* Do MSE for historical time frame say for 2007 and 2008

Rationale: The current proposal for estimating the probability of the point estimate of spawning stock biomass falling below $B_{20\%}$ presents results for 2009 and 2010 only. Given issues of changing selectivity (also weights-at-age) and underestimation of future spawning stock biomass, at a minimum there should be an evaluation of this approach for existing data, that is, projecting forward from 2007 to 2008 and from 2008 to 2009.

Response: While such an exercise was considered useful, the amount of time required for the MCMC runs (see page 58 of the SAFE document) did not make it feasible to do during the panel review. Jim Ianelli agreed to include this evaluation in the next assessment cycle.

*ii.* Look at retrospective MSY $B_0$, $F_{MSY}$ estimates.

Rationale: A subtlety that escaped us at first was that with changing annual selectivity (and weights-at-age), the $B_{MSY}$ and $F_{MSY}$ used to scale the annual estimates of spawning stock biomass and fishing mortality also change annually (although the caption in Fig. 1.35 and text on page 66 did indicate use of annual estimates of $F_{MSY}$). Note that stock-recruitment parameters do stay the same over time (although steepness was changed in the most recent assessment). This also means that the current $B_{20\%}$ was also scaled by the most recent estimate of $B_{MSY}$. The panel requested information on the trends in annual estimates of these reference points to understand their potential influence on the trends in Fig. 1.35.

Response: The variability of $B_{MSY}$ ranged from 1.73 to 2.10 million tons of female spawning biomass but the estimates of $F_{MSY}$ varied considerably more ranging from 0.5 to 1.1 depending on annual selectivity estimates. From 2003 to 2007, $F_{MSY}$ declined while exploitation increased (Fig. 1.33) and then increased in 2008 while exploitation declined. This opposition of trends would suggest a steeper slope for recent relative Fs compared to the trend in Fig. 1.35. In contrast, the trend for $B_{MSY}$ has been flat for 2002 to 2004 and at a lower level but also flat for 2005 to 2008.

*iii.* Compare selectivity with something where time-varying selectivity is halved, and try with age-error turned on. Examine the sensitivity of different ranges of years over which to average selectivity for ABC/OFL estimations.

Rationale: Changes in annual selectivity were constrained using a random walk process but the variance for the random walk was set quite high to fit the catch biomass precisely (page 139 of SAFE document). The current range of years for average selectivity was 2004–2009. Turning on the age-error option was an attempt to look at the impact of including ageing errors.

Response: The impacts of decreasing the variance, adding age-errors and averaging over the previous 4 years, 2 years and only using the current year were evaluated in terms of changes to the harmonic and arithmetic mean of the resulting distribution for $F_{MSY}$ relative to those of the original stock assessment. The changes to the means was negligible for the different options and there was a very slight increase in variability when going from averaging four years to using the current year selectivity (approximating from the graph supplied to us and assuming a lognormal distribution for $F_{MSY}$, the CV increased from around 0.35 to 0.42).

*iv.* Show likelihood tables and diagnostics for residuals and alternative lack of fits

Rationale: The panel requested some standard diagnostics to help understand model behavior.

Response: Observed and predicted points were presented in Figs. 1.28, and 1.30 of the SAFE document for bottom trawl and acoustic trawl survey estimates of age 2+ numbers. Observed and predicted fishery mean catch-at-age were presented in Fig. 1.47 to compare results for fishery selectivity changing only every two-years (previous assessments) and changing every year (current assessment). The panel would have preferred seeing actual (standardized) residual plots than have to visualize the subtraction of observed/predicted points given on the graph. A color-coded table of Pearson normalized residuals for the fishery age composition data was provided to the panel. There was no legend for the color coding in the document. No likelihood (by component) tables were supplied.

*v.* Compare SSB in historical assessments (Fig 1.23) for recent year patterns (advice retrospective versus current model retrospective).

Rationale: The assessment presented model retrospective in terms of spawning stock biomass in Fig. 1.23 while "advice" retrospective was presented in Figure 1.34 in terms

of age 3+ biomass. The panel asked to see these two figures both using spawning stock biomass.

Response: Both figures were presented with the latter limited to the different assessment models used in the last four years. Results still indicate that the current model retrospective tends to be pessimistic with respect to recent biomass estimates while the advice retrospective which reflects the different model configurations being used tends to go in the opposite direction.

*vi.* Table of F-at-age

Rationale: All fishing mortalities presented in the document have been filtered through annual estimated selectivities and maturity ogives. The panel wanted to see the trends in fishing mortality-at-age separate from these filters.

Response: A table of F-at-age for ages 1 to 15 from 1964 to 2009 was presented along with a comparison of the spawning stock exploitation rate and the rate for ages 7+. The table clearly shows that F-at-age has been increasing on all ages from 3 to 15 since 1998. However, the comparison of spawning stock and ages 7+ indicates that the recent divergence in trends (increasing for 7+, declining for spawning stock) was due to the influx of younger pollock with very low fishing selectivity to the spawning stock. These results do not discredit the current stock assessment, the panel needed to see these various bits and pieces to understand the different views of the stock being conveyed by the estimates of spawning stock exploitation, relative F and relative biomass.

*vii.* Include PDF of $F_{MSY}$

Rationale: The main distinguishing characteristic of a tier 1 stock is that the probability density function of (PDF) $F_{MSY}$ can be estimated, however, the PDF was not given in the document.

Response: The density plot for $F_{MSY}$ was presented indicating a relatively skewed distribution with a fairly heavy right-hand tail. I assume that the PDF was not generated from a full Bayesian integration but was obtained from the approximation to this integration. If this was true then it would be helpful to know how good this approximation is for the actual PDF. In particular, it would be useful to know whether the approximation captured the variability present in the Bayesian result. The spread between the arithmetic mean ($F_{MSY}$) and harmonic mean ($F_{ABC}$) is a function of this variability.

d) Evaluation, findings, and recommendations on the appropriateness of the harvest strategy used by the North Pacific Fishery Management Council (including uncertainty adjustments and whether this uses the best scientific information available).

The panel did not really deal with the harvest strategy in detail during the meeting. We did briefly discuss how the $F_{MSY}$ (or $F_{OFL}$) and $F_{ABC}$ were arrived at. The buffer based on using the arithmetic mean for the $F_{OFL}$ and the harmonic mean for the $F_{ABC}$ appeared reasonable given that the spread between the two kinds of means will increase with increasing uncertainty (for

some distributions such as the lognormal, this spread can be calculated). The panel did not discuss the uncertainty adjustments at all.

The population model used for this stock assessment is highly sophisticated, integrating large amounts of data from diverse sources and our scrutiny of it reflected the consequent high expectations for the performance of the model given the economic value of the pollock fishery. Despite the concerns raised, the stock assessment model represents the best scientific information available for provision of advice on this stock. The supporting fishery and fishery-independent data programs are of high quality and should continue to be supported. The large scale ecological research programs will surely provide valuable information that will not only inform the stock assessment process but our general understanding the marine processes in this part of the world. The collaboration between NMFS and the fishing industry is to be envied.

e) Evaluation, findings, and recommendations of whether harvest strategy is adequate within an ecosystem approach to management (e.g., bycatch, importance of pollock as forage).

The harvest strategy is not simply the rules applied to obtain $F_{ABC}$ and the evaluation of whether overfishing is occurring or the stock is overfished or both. There are also the area/time closures to deal with bycatch and the observer program for bycatch and prohibited species. An important unique attribute of the Alaska fishery is the fishing fleet's support and use of the SEA STATE summary of the observer data to confirm known bycatch areas, to decide on areas that may be better off closed because bycatch is consistently high and to identify on a real time basis new high bycatch areas or areas that no longer appear to produce high bycatch rates. There is also the overall cap on the groundfish catch which comes into play. Finally, there is the $B_{20\%}$ rule with respect to closing down the directed fishery if the spawning stock biomass falls below 20% of the unfished spawning stock biomass with some probability.

Aspects of all of the above were touched during the presentations and discussion but the panel did not go into any of these in detail due to time limitations. With respect to the calculating the probability of the biomass dropping below $B_{20\%}$, the panel did recommend in item c(i) above that the proposal for estimating this probability be tested on recent years where the point estimates of spawning stock biomass in the projected years were known. The panel did spend some time on a letter from OCEANA expressing concerns about how the $B_{20\%}$ rule was actually being applied. While there was some misunderstanding in the letter on what the estimate of spawning stock biomass represents at any one time in the year, their concern about the tendency of the model to overestimate next year's biomass is a real one. The current prognosis is that the female spawning stock biomass is estimated to be below the $B_{MSY}$ level for 2010 but is increasing and presently projected to be above $B_{MSY}$ by 2012. The mainstay of this projection is the 2006 year-class, the size of which has already been revised downwards.

f) Recommendations for further assessment improvements for management in both the long and short term.

There was a table in the PowerPoint presentation which indicated changes that have been either made to the model or investigated for the model since 1998. There were changes made to the model in 2009 (e.g., different prior on steepness) and more changes are planned for the model in 2010, e.g., using splines to model the selectivities to reduce the number of parameters. Figure

1.34 of the SAFE document indicates that there is an advice retrospective such that projected estimated biomass tends to be overestimated. Retrospective patterns for the current assessment are of course limited to the current model. While innovation is to be encouraged, it would be helpful to know what the impacts of these changes are relative to last year's model without the changes. Differences between the new and old models could be used to see if the changes are useful or if they result in changed advice.

The guide to the preparation of Alaska Groundfish SAFE report chapters does not require residual plots or tables of F-at-age. Given the annual changes in $F_{MSY}$ and $B_{MSY}$ due to changing selectivities (and weight-at-age) it would be helpful to have the F-at-age table to understand the patterns in the spawning stock fishing mortalities. Also it is easier to look at residual plots than to have to compare observed and predicted estimates on a graph. The CABE analysis that was presented as a diagnostic was useful although it was also based on graphically comparing observed versus expected quantities but more information on the changes in likelihood components would have also added to assessing the importance of the changes.

Respectfully submitted on 16 July 2010,

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Appendix 1: Bibliography of materials provided for review

## Primary document

2009 SAFE report chapter: http://www.afsc.noaa.gov/REFM/docs/2009/EBSpollock.pdf

## Supplemental documents

*Pollock*


Report from the 2009 workshop on spatial analyses and EBS pollock (website: http://tinyurl.com/23o97z5)

Moss, J.H., E.V. Farley, Jr., A.M. Feldmann, and J.N. Ianelli. (2009). Spatial distribution, energetic status, and food habits of eastern Bering Sea age-0 walleye pollock. Transactions of the American Fisheries Society.

Stahl, J., and G. Kruse. 2008a. Spatial and temporal variability in size at maturity of walleye pollock in the eastern Bering Sea. Transactions of the American Fisheries Society 137:1543–1557.

Kastelle, C. R., and Kimura, D. K. 2006. Age validation of walleye pollock (*Theragra chalcogramma*) from the Gulf of Alaska using the disequilibrium of Pb-210 and Ra-226. ICES Journal of Marine Science, 63: 1520–1529.

Bailey, K.M., T.J. Quinn, P. Bentzen, and W.S. Grant. 1999. Population structure and dynamics of walleye pollock, *Theragra chalcogramma*. Advances in Mar. Biol. 37: 179–255. (reprint)

Marine stewardship certification document (http://www.msc.org/track-a-fishery/certified/pacific/bsai-pollock)

Swartzman, G.L., A.G. Winter, K.O. Coyle, R.D. Brodeur, T. Buckley, L. Ciannelli, G.L. Hunt, Jr., J. Ianelli, and S.A. Macklin (2005). Relationship of age-0 pollock abundance and distribution around the Pribilof Islands with other shelf regions of the Eastern Bering Sea. Fisheries Research, Vol. 74, pp. 273–287.

Stahl, J., and G. Kruse. 2008b. Classification of Ovarian Stages of Walleye Pollock (*Theragra chalcogramma*). In Resiliency of Gadid Stocks to Fishing and Climate Change. Alaska Sea Grant College Program • AK-SG-08-01.


*Past reviews*

1995 REFM External review of EBS pollock
1996 Oceana review of EBS pollock (Ludwig)
2000 CIE Review of EBS pollock (Stokes)
2009 Greenpeace review of EBS pollock model (by Steve Martell, UBC)
Compilation of SSC and Plan Team comments on the assessments (extract from meeting reports)

*Management, observer program, etc*


North Pacific observer program's 2010 Observer Sampling Manual

Cahalan, J, J Mondragon, and J Gasper. 2010. Catch sampling and estimation in the Federal groundfish fisheries off Alaska, 42 p. Online

Barbeaux, S. J., S. Gaichas, J. N. Ianelli, and M. W. Dorn. 2005. Evaluation of biological sampling protocols for at-sea groundfish observers in Alaska. Alaska Fisheries Research Bulletin 11(2):82–101. (Online)

NPFMC Fisheries management plan. http://www.fakr.noaa.gov/npfmc/fmp/bsai/BSAI.pdf


Report of the 2002 Harvest strategy review and AFSC comments on 2002 Harvest Strategy Review
Technical Guidance on Precautionary Approach and NS 1
Salmon EIS: http://www.fakr.noaa.gov/sustainablefisheries/bycatch/default.htm)

*Survey documents*


Lauth, R. R. 2010. Results of the 2009 eastern Bering Sea continental shelf bottom trawl survey of groundfish and invertebrate resources, 228 p. Online

Kotwicki, S., T.W. Buckley, T. Honkalehto, and G. Walters. 2005. Variation in the distribution of walleye pollock (*Theragra chalcogramma*) with temperature and implications for seasonal migration. Fish. Bull 103:574–587.

Honkalehto, T., N. Williamson, D. Jones, A. McCarthy, and D. McKelvey. 2009. Results of the Echo Integration-Trawl Survey of Walleye Pollock (*Theragra chalcogramma*) on the U.S. and Russian Bering Sea Shelf in June and July 2007. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-194. http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-194.pdf

Ressler, P. T. Honkalehto, R. Towler, amd C. Wilson. 2008. Using acoustic data from vessels of opportunity to estiimate walleye pollock abundance in the Eastern Bering Sea. ICES CIEM SEAFACTS International Symposium on the Ecosystem Approach. Bergen, Nor way, June 2008.

von Szalay PG, Somerton DA, Kotwicki S. 2007. Correlating trawl and acoustic data in the Eastern Bering Sea: A first step toward improving biomass estimates of walleye pollock (*Theragra chalcogramma*) and Pacific cod (*Gadus macrocephalus*)? Fisheries Research 86(1): 77–83.
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Williamson, N., and J. Traynor. 1996. Application of a one-dimensional geostatistical procedure to fisheries acoustic surveys of Alaskan pollock. ICES J. Mar. Sci. 53:423–428.

*Ecosystem*

Ecosystem considerations: http://www.afsc.noaa.gov/REFM/docs/2009/ecosystem.pdf
Bering Sea Integrated Ecosystem Research Plan http://bsierp.nprb.org/
Jurado-Molina J., P. A. Livingston and J. N. Ianelli. 2005. Incorporating predation interactions to a statistical catch-at-age model for a predator-prey system in the eastern Bering Sea. Canadian Journal of Fisheries and Aquatic Sciences. 62(8): 1865–1873.

*Other documents*

NMFS workshop report on natural mortality (website: http://tinyurl.com/27grn7z)
December 2009 Letter from Oceana to NPFMC
Stahl and Kruse 2008a. Classification of Ovarian Stages of Walleye Pollock
Stahl and Kruse 2008b. Spatial and Temporal Variability in Size at Maturity of Walleye Pollock in the Eastern Bering Sea
Ianelli, J.N. and D.A. Fournier. 1998. Alternative age-structured analyses of the NRC simulated stock assessment data. In Restrepo, V.R. [ed.]. Analyses of simulated data sets in support of the NRC study on stock assessment methods. NOAA Tech. Memo. NMFS-F/SPO-30. 96 p.
Kimura, D.K., J.J. Lyons, S.E. MacLellan, and B.J. Goetz. 1992. Effects of year-class strength on age determination. Aust. J. Mar. Freshwater Res. 43:1221–8.
Wespestad, V. G., L. W. Fritz, W. J. Ingraham, and B. A. Megrey. 2000. On relationships between cannibalism, climate variability, physical transport, and recruitment success of Bering Sea walleye pollock (*Theragra chalcogramma*). ICES Journal of Marine Science 57:272–278

# Attachment A: Statement of Work for Stephen Smith

## External Independent Peer Review by the Center for Independent Experts

## Eastern Bering Sea Pollock Stock Assessment and Management Methods

**Scope of Work and CIE Process:** The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's Technical Representative (COTR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers are selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in **Annex 1**. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from www.ciereviews.com.

**Project Description:** The Alaska Fisheries Science Center (AFSC) requests a Center of Independent Experts (CIE) review of stock assessments for the Eastern Bering Sea pollock stock assessment and management. The pollock fishery is large and the species involved is a key component of the ecosystem. The population dynamics characteristics and central role in North Pacific groundfish fisheries justify the need for periodic review of the scientific approaches for assessment and recommendations for management. Recent research projects studied movements, stock structure and reproductive ecology of pollock. The Bering Sea Integrated Ecosystem Research Program (BSIERP) funded a management strategy evaluation component that has the potential for guiding changes if needed in current management practices. A CIE review will provide timely feedback to these studies, and will be useful for the management of the Eastern Bering Ecosystem and fisheries. The ToRs of the peer review are attached in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**.

**Requirements for CIE Reviewers:** Three CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. CIE reviewers shall have working knowledge and recent experience in the application of stock assessment, including population dynamics, separable age-structured models, harvest strategies, survey methodology, and the AD Model Builder programming language. They should also have experience conducting stock assessments for fisheries management. Each CIE reviewer's duties shall not exceed a maximum of 14 days to complete all work tasks of the peer review described herein.

**Location of Peer Review:** Each CIE reviewer shall conduct an independent peer review during the panel review meeting tentatively scheduled at the Alaska Fisheries Science Center in Seattle, Washington during 28 June through 2 July 2010.

**Statement of Tasks:** Each CIE reviewers shall complete the following tasks in accordance with the

SoW and Schedule of Milestones and Deliverables herein.

Prior to the Peer Review: Upon completion of the CIE reviewer selection by the CIE Steering Committee, the CIE shall provide the CIE reviewer information (full name, title, affiliation, country, address, email) to the COTR, who forwards this information to the NMFS Project Contact no later the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewers with the background documents, reports, foreign national security clearance, and other information concerning pertinent meeting arrangements. The NMFS Project Contact is also responsible for providing the Chair a copy of the SoW in advance of the panel review meeting. Any changes to the SoW or ToRs must be made through the COTR prior to the commencement of the peer review.

Foreign National Security Clearance: If the panel review meeting is conducted at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for CIE reviewers who are non-US citizens. For this reason, the CIE reviewers shall provide requested information (e.g., first and last name, contact information, gender, birth date, passport number, country of passport, travel dates, country of citizenship, country of current residence, and home country) to the NMFS Project Contact for the purpose of their security clearance, and this information shall be submitted at least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website: http://deemedexports.noaa.gov/sponsor.html).

Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the CIE reviewers the necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE Lead Coordinator on where to send documents. CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. The CIE reviewers shall read all documents in preparation for the peer review. The list of documents and background papers are provided at the end of this document

Panel Review Meeting: Each CIE reviewer shall conduct the independent peer review in accordance with the SoW and ToRs, and shall not serve in any other role unless specified herein. **Modifications to the SoW and ToRs can not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COTR and CIE Lead Coordinator.** Each CIE reviewer shall actively participate in a professional and respectful manner as a member of the meeting review panel, and their peer review tasks shall be focused on the ToRs as specified herein. The NMFS Project Contact is responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements). The NMFS Project Contact is responsible for ensuring that the Chair understands the contractual role of the CIE reviewers as specified herein. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

Contract Deliverables - Independent CIE Peer Review Reports: Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review according to required format and content as described in Annex 1. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in Annex 2.

Other Tasks – Contribution to Summary Report: Each CIE reviewer may assist the Chair of the panel review meeting with contributions to the Summary Report, based on the terms of reference of the review. Each CIE reviewer is not required to reach a consensus, and should provide a brief summary of the reviewer's views on the summary of findings and conclusions reached by the review panel in accordance with the ToRs.

**Specific Tasks for CIE Reviewers:** The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
2) Participate during the panel review meeting in Seattle, Washington during 28 June through 2 July 2010, as specified herein.
3) LOCATION and DATES as specified herein, and conduct an independent peer review in accordance with the ToRs (**Annex 2**).
4) No later than 16 July 2010, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Mr. Manoj Shivlani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and CIE Regional Coordinator, via email to David Die ddie@rsmas.miami.edu. Each CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in **Annex 2**.

**Schedule of Milestones and Deliverables:** CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

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| 17 May 2010 | CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact |
| 7 June 2010 | NMFS Project Contact sends the CIE Reviewers the pre-review documents |
| 28 June – 2 July 2010 | Each reviewer participates and conducts an independent peer review during the panel review meeting |
| 16 July 2010 | CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator |
| 30 July 2010 | CIE submits CIE independent peer review reports to the COTR |
| 6 August 2010 | The COTR distributes the final CIE reports to the NMFS Project Contact and regional Center Director |

**Modifications to the Statement of Work:** Requests to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the COTR within 10 working days after receipt of all required information of the decision on substitutions. The COTR can approve changes to the milestone dates, list of pre-review documents, and ToRs within the SoW as long as the role and ability of the CIE reviewers to complete the deliverable in accordance with the SoW is not adversely impacted. The SoW and ToRs shall not be changed once the peer review has begun.

**Acceptance of Deliverables:** Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COTR for final approval as contract deliverables based on compliance with the SoW and ToRs. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (CIE independent peer review reports) to the COTR (William Michaels, via William.Michaels@noaa.gov).

**Applicable Performance Standards:** The contract is successfully completed when the COTR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards:
(1) each CIE report shall completed with the format and content in accordance with **Annex 1**,
(2) each CIE report shall address each ToR as specified in **Annex 2**,
(3) the CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

**Distribution of Approved Deliverables:** Upon acceptance by the COTR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COTR. The COTR will distribute the CIE reports to the NMFS Project Contact and Center Director.

**Support Personnel:**

William Michaels, Contracting Officer's Technical Representative (COTR)
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1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
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Roger W. Peretti, Executive Vice President
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**Key Personnel - NMFS Project Contact:**
James Ianelli
NMFS Alaska Fisheries Science Center, 7600 Sand Point Way NE, Seattle, WA 98115
Jim.Ianelli@noaa.gov Phone: (206) 526-6510

William A. Karp, AKFC Science Director
National Marine Fisheries Service, NOAA, Alaska Fisheries Science Center
7600 Sand Point Way, NE, Bldg 4, Seattle, WA 98115
Bill.Karp@noaa.gov Phone: 206-526-4000

Appendix 3: Panel membership and other pertinent information from the panel review meeting

The members of the panel were:

Chris Darby
CEFAS
Lowestoft, UK

Stephen J. Smith
Bedford Institute of Oceanography
Dartmouth, Nova Scotia, Canada

Kevin Stokes
Private Consultant
stokes.net.nz Ltd
Wellington, New Zealand

List of participants

| | | |
|---|---|---|
| Bill Karp<br>Bill.Karp@noaa.gov<br>Alaska Fisheries Science Center | Pat Ressler<br>Patrick.Ressler@noaa.gov<br>Acoustic program<br>RACE/AFSC | Ruth Christiansen<br>ruth.christiansen@alaska.gov<br>Alaska Department of Fish and Game |
| Anne Hollowed<br>Anne.Hollowed@noaa.gov<br>Status of stocks program<br>REFM/AFSC | Mike Guttormsen<br>Mike.Guttormsen@noaa.gov<br>Acoustic program<br>RACE/AFSC | Gary Stauffer<br>GaryStauffer47@msn.com<br>Fishery Science Advisors |
| Thomas Helser<br>Thomas.Helser@noaa.gov<br>Age and growth program<br>REFM/AFSC | Mathieu Woillez<br>Mathieu.Woillez@noaa.gov<br>Acoustic program<br>RACE/AFSC | Terry Quinn<br>Terry.Quinn@alaska.edu<br>University of Alaska Fairbanks (in Juneau) |
| Betty Goetz<br>Betty.Goetz@noaa.gov<br>Age and growth program<br>REFM/AFSC | Chris Wilson<br>Chris.Wilson@noaa.gov<br>Acoustic program<br>RACE/AFSC | Hyung Kee Cha<br>cha1212@nfrdi.go.kr<br>NFRDI, Busan, ROK |
| Steve Barbeaux<br>Steve.Barbeaux@noaa.gov<br>Status of stocks program<br>REFM/AFSC | Dave Somerton<br>David.Somerton@noaa.gov<br>Groundfish Survey group<br>RACE/AFSC | Jae-Bong Lee<br>leejb@nfrdi.go.kr<br>NFRDI, Busan, ROK |
| Teresa A'mar<br>TeresaAmar@noaa.gov<br>Status of stocks program<br>REFM/AFSC | Ken Weinberg<br>Ken.Weinberg@noaa.gov<br>Groundfish Survey group<br>RACE/AFSC | Ed Richardson<br>erichardson@atsea.org<br>At Sea Processor Association |
| Martin Dorn<br>Martin.Dorn@noaa.gov | Loh-Lee Low<br>Loh-Lee.Low@noaa.gov | Paul MacGregor<br>PMacgregor@mundtmac.com |

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|---|---|---|
| Status of stocks program<br>REFM/AFSC | International coordinator<br>AFSC | At Sea Processor Association |
| Jim Ianelli<br>Jim.Ianelli@noaa.gov<br>Status of stocks program<br>REFM/AFSC | Liz Moffitt<br>emoffitt@UW.edu<br>Post-doc, REFM/AFSC | John Warrenchuk<br>jwarrenchuk@oceana.org<br>Oceana |
| Taina Honkalehto<br><br>Taina.Honkalehto@noaa.gov<br>Acoustic program<br>RACE/AFSC | Industry/Council/other<br>Jane Dicosimo<br>Jane.Dicosimo@noaa.gov<br>N. Pac. Fishery Mgt Council | Jan Jacobs<br>jan.jacobs@americanseafoods.com<br>American Seafoods |
| Kresimir Williams<br>Kresimir.Williams@noaa.gov<br>Acoustic program<br>RACE/AFSC | Diana Stram<br>Diana.Stram@noaa.gov<br>N. Pac. Fishery Mgt Council | |

**Agenda—Eastern Bering Sea Pollock Stock Assessment and Management Methods**

Alaska Fisheries Science Center
7600 Sand Point Way NE, Seattle, WA 98115Seattle, Washington
Week of June 28th 2010

**Security and check-in**: Julie Pearce Julie.Pearce@noaa.gov (206) 526 6547
**Additional documents**: James Ianelli, Jim.Ianelli@noaa.gov (206) 526 6510

*Format will be from 9AM to 5PM each day with time for lunch and morning and afternoon breaks.*

**Monday, June 28th**
Morning

**1. Preliminaries**

a. Introductions
b. Adopt agenda
c. Overview of EBS pollock biology, fishery, and history of assessment

2. **Fishery independent data**

a. Biological—stock structure, maturity, age and growth, mortality

Afternoon

b. Groundfish survey data—abundance indices, age compositions
c. Acoustic survey data—abundance indices, age compositions
d. Research areas—alternative survey indices, opportunistic studies

**Tuesday, June 29th**
Morning

e. Food habits studies, multispecies modeling, BSIERP studies

**3. Fishery data**

a. Observer program overview Sampling protocols
b. Catch accounting system
c. Age composition estimation

Afternoon

**4. Management**

a. Inseason management practices
b. Bycatch regulations and studies
c. Economic considerations

**5. Assessment model details**

a. Issues:
   i. Catchability in surveys
   ii. Likelihood formulations, data weighting
   iii. Selectivity
   iv. Spatial dynamics

**Wednesday, June 30th**

Assessment model continued…

**6. Model alternatives/sensitivities**

a. Alternative model runs, further discussion as needed

**Thursday, July 1st**

**7. Discussions and summaries** continued…